



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/562,496

12/27/2005

Martin Schmidt

GK-OEH-226/500814.20128

6590

26418

7590

02/05/2009

REED SMITH, LLP

ATTN: PATENT RECORDS DEPARTMENT

599 LEXINGTON AVENUE, 29TH FLOOR

NEW YORK, NY 10022-7650

EXAMINER

CHANG, HANWAY

ART UNIT

PAPER NUMBER

4183

MAIL DATE

DELIVERY MODE

02/05/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/562,496	Applicant(s) SCHMIDT ET AL.	
	Examiner Hanway Chang	Art Unit 4183	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12/27/2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 29-57 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 29-32, 34-49, and 52-56 is/are rejected.
- 7) ☒ Claim(s) 33,50,51 and 57 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 December 2005 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>12/27/2005</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Drawings

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the (i)pulse compressor of claim 43, (ii)capacity bank of claim 44, (iii)power on-off switch of claim 46, (iv)logic control element of claim 46, and (v)cryogenic target injector of claim 51 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

The disclosure is objected to because of the following informalities:

Paragraph [0037] finishes a sentence without the use of a period.

Paragraph [0047] recites "... (case of DBPLL device)." which appears to be a misspelling of the acronym DBLPP previously used.

Paragraph [0048] recites both a "vacuum chamber 3" and a "source chamber 3". The use of consistent terminology is appreciated. It is suggested to change both these terms to read "vacuum chamber 3" or "first vacuum chamber 3".

Paragraph [0048] further recites "...generated by a laser source 21..." and is suggested to change to read "...generated by a laser source ~~24~~ 12..." to be consistent with the drawings and the rest of the specification.

Paragraph [0058] recites "...driving power is cheep electrical power..." and is suggested to read "...driving power is ~~cheep~~ cheap electrical power..."

Appropriate correction is required.

Claim Objections

Claim 32 is objected to because of the following informalities: The claim recites in the third line of the claim "...actively triggered in adelocalised interaction zone..." which appears to be a misspelled form of "a delocalized".

Claim 42 is objected to because of the following informalities: The claim recites in the third line of the claim "said electrodes located around..." which lacks antecedent basis.

Claim 50 is objected to because of the following informalities: The claim recites in the second line of the claim "...evacuating the head load produced..." which appears to be a misspelling of the term "heat load".

Claim 51 is objected to because of the following informalities: The claim recites in the second line of the claim "...acts as a head shield for..." which appears to be a misspelling of the term "heat shield".

Claim 57 is objected to because of the following informalities: The claim recites in the fifth line of the claim "...when the pinch process makes..." which lacks antecedent basis.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 54 recites the limitation "A device according to claim 42, comprising a laser source" which is unclear if the laser source is referring to the same laser source as recited in independent claim 42 or an additional laser source. In this office action, it is to be understood that the laser source is the same laser source of claim 42.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 29, 31-32, 34-35, 37-47, and 54-56 are rejected under 35 U.S.C. 102(e) as being anticipated by Melnychuk et al. (US PGPub 2005/0230645, hereinafter Melnychuk).

Regarding claims 29 and 42, Fig. 4C of Melnychuk discloses a laser source for producing a laser radiation which is focused to intensities beyond 10^6 W/cm² (see paragraph [0122]) onto a target to produce a plasma (see paragraph [0135]), electrodes located around the path of the plasma produced by the laser source (see paragraph [0133]), and said electrodes being combined with means for producing a rapid electric discharge in the plasma (see paragraph [0133]). It should be noted that in the applicant's specification, the time constant of the rapid electric discharge between the electrodes is preferably in the order of 200 ns or less. Melnychuk discloses a similar laser source and target; therefore the laser produced plasma expansion time must inherently be similar. Melnychuk discloses the time constant of the electric discharge to be 30-100 ns (see paragraph [0133]) which is less than 200 ns. Therefore, Melnychuk

Art Unit: 4183

inherently discloses a characteristic time constant which is less than the time constant of the laser produced plasma expansion time.

Regarding claims 31 and 32, Fig. 4C of Melnychuk discloses an EUV plasma first produced by the laser radiation focused on a dense target in a laser interaction zone and subsequently a discharge is induced across the laser interaction zone thereby boosting the initial laser produced plasma and enhancing total EUV light production (see paragraph [0135]). It should be noted that the laser interaction zone is only defined as the location the laser and target intersect.

Further regarding claim 32, Melnychuk discloses that the laser radiation is pulsed (see paragraph [0116]), therefore the times when the laser is not acting upon the target, there is no defined interaction zone. Therefore it will be understood that the former interaction zone becomes a delocalized interaction zone where the discharge is actively triggered to heat and compress the plasma.

Regarding claims 34 and 45, Fig. 2A(1) of Melnychuk discloses the electrodes (2A(2)) are connected directly to the capacity bank to produce the rapid electric discharge (see paragraph [0105]).

Regarding claims 35 and 47, Melnychuk discloses a discharge time between the electrodes is 100 ns (see paragraph [0104]). Furthermore with a few basic mathematical manipulations, any value chosen can be made to be represented in a one-to-three digit nanosecond range with the use of significant figures and powers of 10.

Further regarding claim 47, Melnychuk further discloses the laser pulses generated by the laser source is 20 ns (see paragraph [0122]).

Regarding claim 37, Melnychuk discloses the current pulses that are applied in the presence of plasma by the electrodes are switched in a defined temporal relation with the firing of the laser pulses produced by the laser source (see paragraph [0135]).

Regarding claim 46, Melnychuk discloses the electrodes are connected to the capacity bank through a power on-off switch which is switched on by a logic control element to produce said rapid electric discharge (see paragraph [0098]).

Regarding claim 38, Melnychuk discloses that in order to produce EUV from plasma, the temperature of the plasma must be in the range of several thousand degrees Celsius (see paragraph [0060]). With a few basic mathematical manipulations, any temperature chosen can be made to be represented in a six digit Kelvin range with the use of significant figures and powers of 10.

Regarding claim 39, Melnychuk discloses a target gas used to produce plasma is at a pressure of 0.01 Torr (see paragraph [0134]). It should be noted that 0.01 Torr is approximately 1 Pa, which is inherently less than 10 Pa.

Regarding claim 40, Melnychuk discloses the plasma emits radiation with wavelengths shorter than 50 nm (13-14 nm)(see paragraph [0062]).

Regarding claim 41, Melnychuk discloses the target is xenon (see paragraph [0134]).

Regarding claim 43, Melnychuk discloses a magnetic compression circuit (see abstract).

Regarding claim 44, Fig. 1 of Melnychuk discloses a means for storing electrical energy comprising a capacity bank (C-1) (see paragraph [0073]).

Regarding claim 54, Melnychuk discloses a laser source for producing a laser radiation which is focused to intensities beyond 10^6 W/cm² onto a dense target to produce plasma (see paragraph [0122]). It should be noted that the term "dense" is relative and any target can be considered "dense" because it has an inherent density.

Regarding claim 55, Fig. 4C of Melnychuk discloses a laser beam produced by a source irradiating an effusive gas target to produce a cold plasma plume and the discharging electrodes are arranged on the path of the plasma plume with the laser interaction zone, the discharging electrodes contributing to heat and compress the plasma for more confined EUV emission (see paragraphs [0133—0135]).

Regarding claim 56, Fig. 2A(1) of Melnychuk discloses a pulse generator (404) connected to the electrodes (2A(2)) that triggers an electrical discharge as the plasma plume enters the space between the electrodes (see paragraph [0105]).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 30, 36, 48-49, and 52-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Melnychuk.

Regarding claim 30, Melnychuk discloses the target for producing plasma is a cluster spray (see paragraph [0130]). Melnychuk does not disclose that the cluster

Art Unit: 4183

spray is more than 10^{19} atoms/cm³. However, one of ordinary skill in the art at the time the invention was made would have known that the spray density is a result-effective variable that affects the produced plasma. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the invention of Melnychuk by providing the target with more than 10^{19} atoms/cm³, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claim 36, a difference between Melnychuk and the claimed invention is the current pulses that are applied in the presence of plasma by the electrodes are selected with amplitudes in a two-to-three digit kilo-ampere range. However, one of ordinary skill in the art at the time the invention was made would have known that the current pulses are a result-effective variable that affects the discharge of the electrodes. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the invention of Melnychuk by selecting a current pulse with amplitudes in a two-to-three digit kilo-ampere range, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. Furthermore with a few basic mathematical manipulations, any value chosen can be made to be represented in a two-to-three digit kilo-ampere range with the use of significant figures and powers of 10.

Regarding claim 48, Fig. 4C of Melnychuk discloses a hybrid EUV system using both electrode discharge and a laser source to produce plasma in a vacuum chamber equipped by at least one electrically insulating block to hold the electrodes around a

Art Unit: 4183

laser interaction zone of the target. Melnychuk does not explicitly teach a nozzle for injecting a cluster jet target in this embodiment. However, Fig. 4B of Melnychuk discloses a laser produced plasma system comprising a laser source and a nozzle for injecting a cluster jet target (see paragraph [0130]). It would have been obvious at the time of invention to a person of ordinary skill in the art to use the laser produced plasma system with the nozzle in the hybrid system as a means of providing a target for the purpose of producing plasma using a well known target provider.

Regarding claim 49, Melnychuk discloses the insulating block is made of diamond coating (see paragraph [0130]). It is known in the art that diamonds are inherently a good electrical insulator. It is also known in the art that diamonds inherently have high thermal conductivity.

Regarding claim 52, Fig. 18A of Melnychuk discloses a second vacuum chamber (14) that is connected to the first vacuum chamber (10) via an orifice (6) for receiving the used target material downstream the EUV light emission zone (see paragraph [0187]).

Regarding claim 53, Melnychuk does not explicitly disclose the arrangement of electrodes in the system. However, Melnychuk discloses well known arrangements of electrodes such as the Z-pinch (see paragraph [0107-0108]), hollow cathode pinch (see paragraph [0110-0112]), or capillary discharge (see paragraph [0114]). It would have been obvious at the time of invention to a person of ordinary skill in the art to use any one of these configurations for the purpose of using a well known configuration of electrodes.

Allowable Subject Matter

Claims 33, 50-51, and 57 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding claim 33, the prior art of record, either singularly or in combination, does not disclose or suggest the combination of limitations including, the EUV plasma is first produced by use of a conventional electrical discharge configuration and subsequently laser radiation is focused on the plasma boosting the initial discharge produced plasma and enhancing the EUV light production.

Regarding claim 50, the prior art of record, either singularly or in combination, does not disclose or suggest the combination of limitations including, the electrically insulating block is cryogenically cooled.

Regarding claim 51, the prior art of record, either singularly or in combination, does not disclose or suggest the combination of limitations including, a cryogenic target injector.

Regarding claim 57, the prior art of record, either singularly or in combination, does not disclose or suggest the combination of limitations including, discharging electrodes which are arranged next to a jet target to produce a high density plasma, and a laser source which irradiates the plasma in a way that sustains the emission of EUV radiation, and a means to trigger the laser pulses when the pinch process makes the plasma dense enough to allow additional laser heating.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hanway Chang whose telephone number is (571)270-5766. The examiner can normally be reached on Monday to Thursday 7:30 AM till 5 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Landau can be reached on (571)272-1731. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Matthew C. Landau/
Supervisory Patent Examiner, Art
Unit 4183

Hanway Chang
January 21, 2009
/H. C./
Examiner, Art Unit 4183

Application/Control Number: 10/562,496
Art Unit: 4183

Page 13